National Semiconductor

March 1995

LM18293 Four Channel Push-Pull Driver

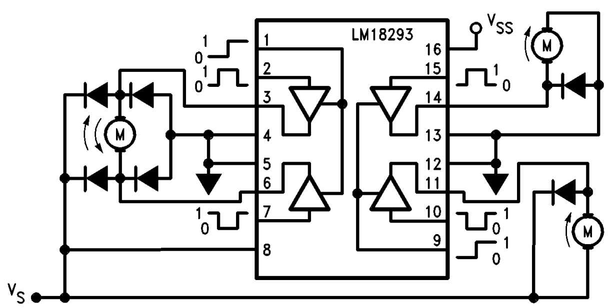
General Description

The LM18293 is designed to drive DC loads up to one amp. Typical applications include driving such inductive loads as solenoids, relays and stepper motors along with driving switching power transistors and use as a buffer for low level logic signals. The four inputs accept standard TTL and DTL levels for ease of interfacing. Two enable pins are provided that also accept the standard TTL and DTL levels. Each enable controls 2 channels and when an enable pin is disabled (tied low), the corresponding outputs are forced to the TRI-STATE® condition. If the enable pins are not connected (i.e., floating), the circuit will function as if it has been enabled. Separate pins are provided for the main power supply (pin 8), and the logic supply (pin 16). This allows a lower voltage to be used to bias up the logic resulting in reduced power dissipation. The chip is packaged in a specially designed 16 pin power DIP. The 4 center pins of this package are tied together and form the die paddle inside the package. This provides much better heat sinking capability than most other DIP packages available. The device is capable of operating at voltages up to 36 volts.

Features

- 1A output current capability per channel
- Pin for pin replacement for L293B
- Special 16 pin power DIP package
- 36 volt operation
- Internal thermal overload protection
- Logical "0" input voltage up to 1.5 volts results in high noise immunity

Typical Connection



TL/H/8706–1

FIGURE 1. Application circuit showing bidirectional and on/off control of a single DC motor using two outputs and unidirectional on/off function of two DC motors using a single output each.

Order Number LM18293N
NS Package Number N16A

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 RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Output Drive Supply Voltage (V_S)	36V
Logic Supply Voltage (V_{SS})	36V
Input Voltage (V_I)	7V
Enable Voltage (V_E)	7V
Peak Output Current (Non-Repetitive t = 5 ms)	2A
Junction Temperature (T_J)	+150°C
Thermal Resistance Junction to Case (θ_{JC})	14°C/W
Thermal Resistance Junction to Ambient (θ_{JA})	80°C/W
Internal Power Dissipation	Internally Limited
Operating Temperature Range	−40°C to +125°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Solder 10 seconds)	260°C

Electrical Characteristics

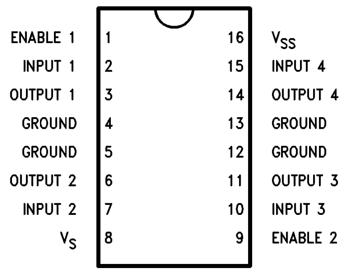
V_S = 24V, V_{SS} = 5V, T = 25°C, L = 0.4V, H = 3.5V, each channel, unless otherwise noted

Symbol	Parameter	Conditions	Typical	Tested Limit (Note 1)	Design Limit (Note 2)	Units
V_S	Main Supply (Pin 8)	Maximum Supply Voltage		36		Vmax
V_{SS}	Logic Supply (Pin 16)	Minimum Logic Supply Voltage Maximum Logic Supply Voltage		4.5 36		Vmin Vmax
I_S	Total Quiescent Supply Current	V_I = L I_O = 0 V_E = H V_I = H I_O = 0 V_E = H V_E = L	2 16	6 24 4		mAmax mAmax mAmax
I_{SS}	Total Quiescent Logic Supply Current (pin 16)	V_I = L I_O = 0 V_E = H V_I = H I_O = 0 V_E = H V_E = L	44 16 16	60 22 24		mAmax mAmax mAmax
V_I	Input Voltage	Min Value of Low Max Value of Low Min Value of High Max Value of High (V_{SS} ≤ 7) Max Value of High (V_{SS} > 7)		−0.3 1.5 2.3 V_{SS} 7		Vmin Vmax Vmin Vmax Vmax
I_I	Input Current	V_I = L V_I = H	 30	−10 100		µAmax µAmax
V_E	Enable Voltage (Pins 1, 9)	Min Value of Low Max Value of Low Min Value of High Max Value of High (V_{SS} ≤7) Max Value of High (V_{SS} >7)		−0.3 1.5 2.3 V_{SS} 7		Vmin Vmax Vmin Vmax Vmax
I_E	Enable Current	V_E = L V_E = H	−30	−100 ±10		µAmax µAmax
V_{CE} sat Top	Source Saturation Voltage	I_o = −1 amp	1.4	1.8		Vmax
V_{CE} sat Bottom	Sink Saturation Voltage	I_o = 1 amp	1.2	1.8		Vmax
t_r	Rise Time	10%–90% V_o	250			ns
t_f	Fall Time	90%–10% V_o	250			ns
t_{on}	Turn-On Delay	50% V_I to 50% V_o	450			ns
t_{off}	Turn-Off Delay	50% V_I to 50% V_o	200			ns

Note 1: Tested limits are guaranteed and 100% production tested.

Note 2: Design limits are guaranteed (but not 100% production tested) over the full supply and temperature range. These limits are not used to calculate outgoing quality levels.

Connection Diagram



Enable 1 activates outputs 1 & 2

Enable 2 activates outputs 3 & 4

TL/H/8706–2

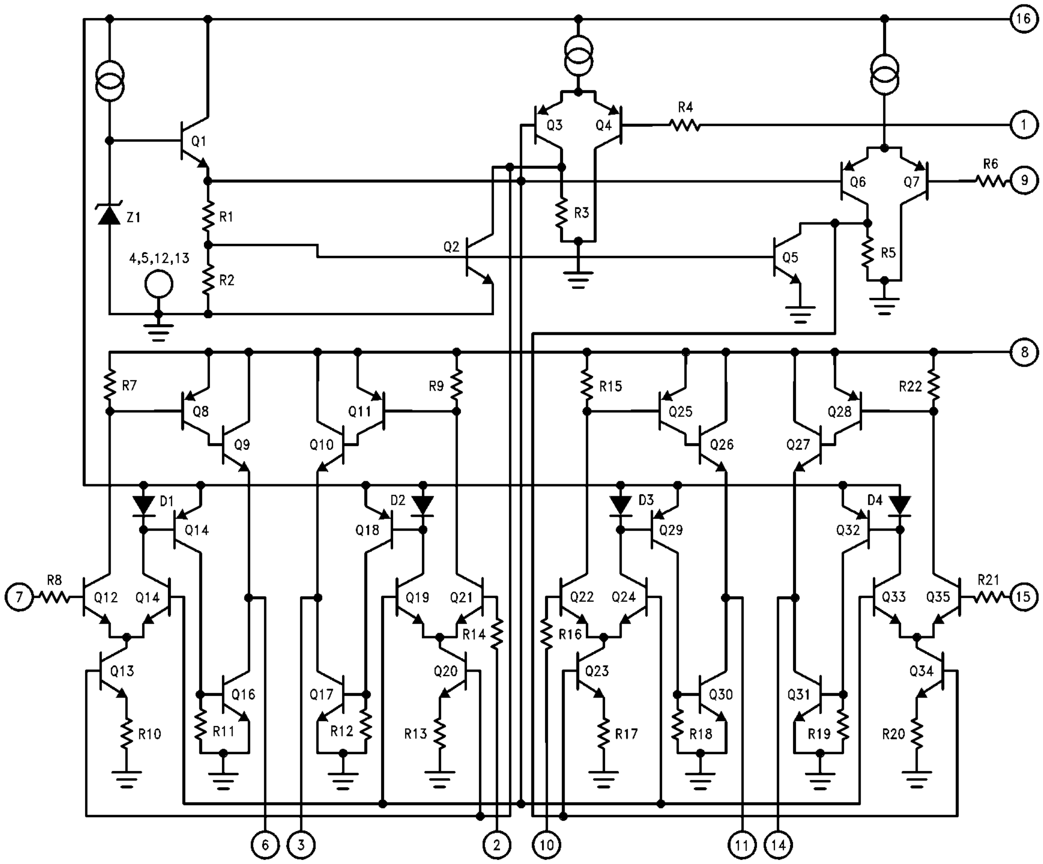
Input/Output Truth Table

V_E (**)	V_I (Each Channel)	V_O
H	H	H
H	L	L
L	H	X (*)
L	L	X (*)

(*) High output impedance.

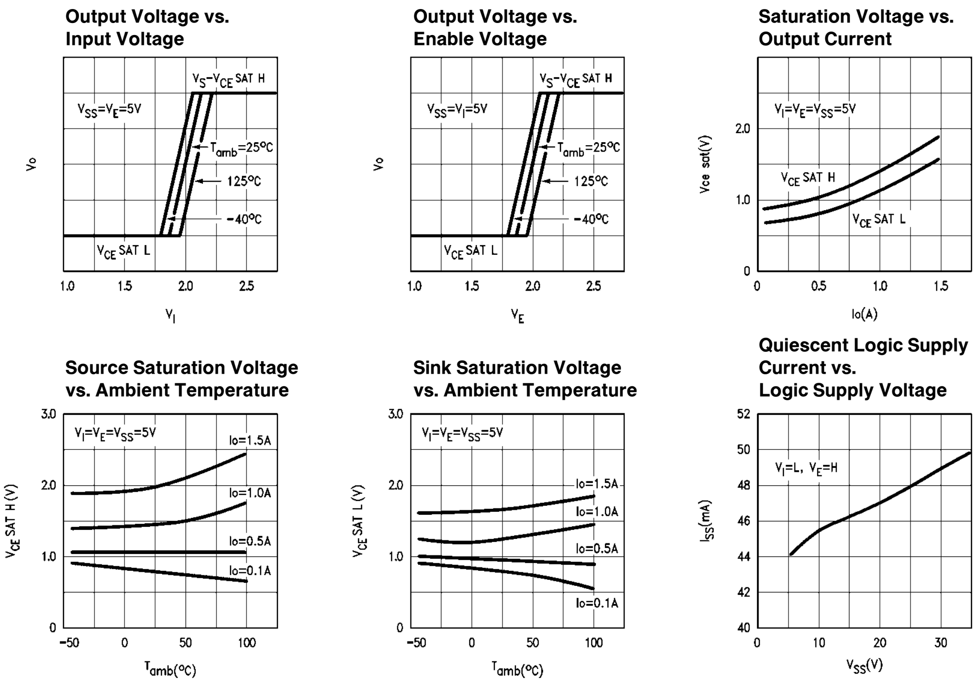
(**) Relative to the pertinent channel.

Simplified Schematic



TL/H/8706–3

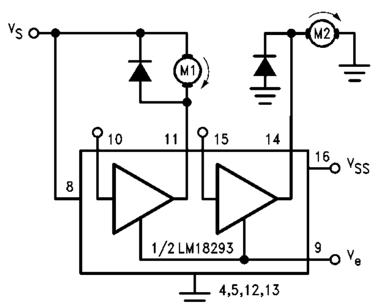
Typical Performance Characteristics V_S In all cases = 24V



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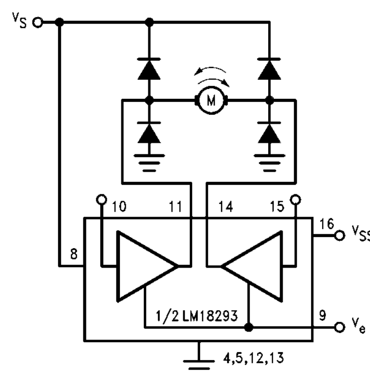
Typical Applications

DC motor controls (with connections to ground and to the supply voltages)



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Bidirectional DC motor control



TL/H/8706–6

V_E	Pin 10	Pin 15	M1	M2
H	H	H	Fast Motor Stop	Run
H	H	L	Fast Motor Stop	Fast Motor Stop
H	L	H	Run	Run
H	L	L	Run	Fast Motor Stop
L	X	X	Free Running Motor Stop	Free Running Motor Stop

L = Low H = High X = Don't care

Inputs		Function
V_E = H	Pin 10 = H Pin 15 = L	Turn CW
	Pin 10 = L Pin 15 = H	Turn CCW
	Pin 10 = Pin 15	Fast Motor Stop
V_E = L	Pin 10 = X Pin 15 = X	Free Running Motor Stop

L = Low H = High X = Don't care

Bipolar Stepping Motor Control

Step Sequencing Tables

Full Step *

V_{IN} 1	V_{IN} 2	Step
L	L	1
L	H	2
H	H	3
H	L	4
L	L	1

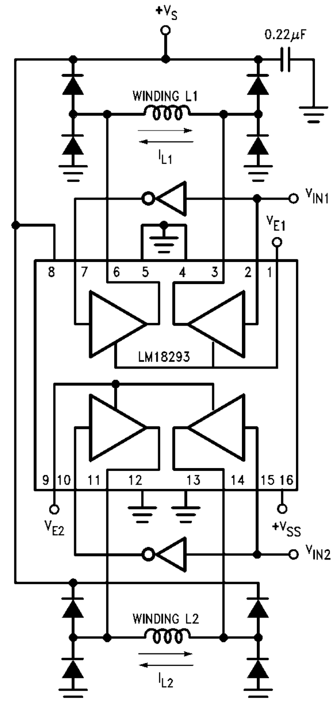
***V_E 1 and V_E 2 = H**

Half Step

V_E 1	V_E 2	V_{IN} 1	V_{IN} 2	Step
H	L	L	X	1
H	H	L	L	2
L	H	X	L	3
H	H	H	L	4
H	L	H	X	5
H	H	H	H	6
L	H	X	H	7
H	H	L	H	8
H	L	L	X	1

H = High L = Low X = Don't care

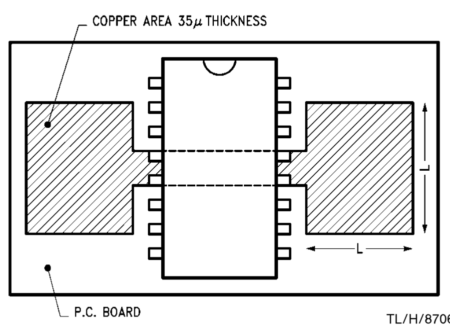
Motor Control Block Diagram



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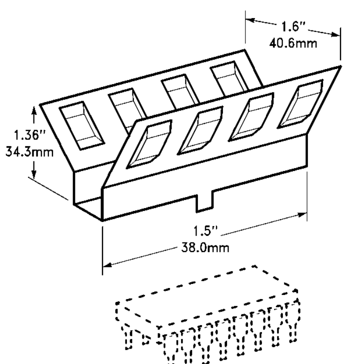
Mounting Instructions

The junction to ambient thermal resistance of the LM18293 can be reduced by soldering the ground pins to a suitable copper area of the printed circuit board or to an external heatsink. The graph below, which shows the maximum power dissipated and junction to ambient thermal resistance as a function of the side "l" of two equal square copper areas having a thickness of 35μ, illustrates this. In addition, it is possible to use an external heatsink (see illustration below). During soldering the pins temperature must not exceed 230°C and the soldering time must not be longer than 12 seconds. The external heatsink or printed circuit copper area must be connected to electrical ground.



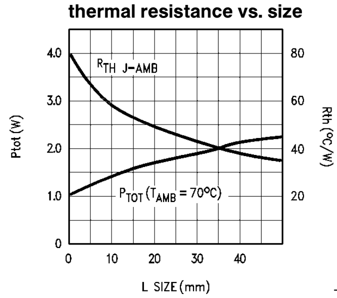
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Staver External Heat-sink



TL/H/8706–10

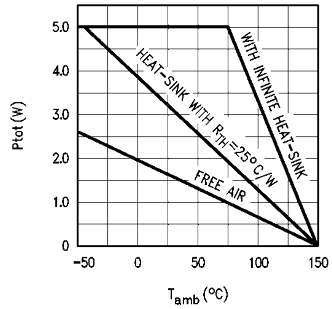
Maximum power dissipated and junction to ambient thermal resistance vs. size



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Mounting Instructions (Continued)

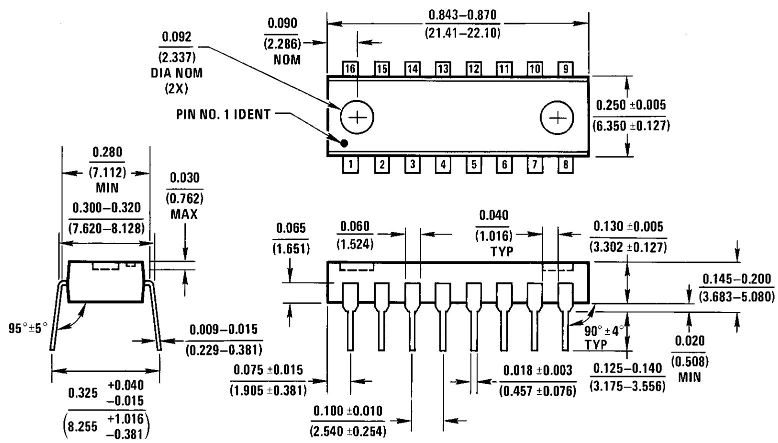
Maximum Allowable Power Dissipation vs Ambient Temperature



TL/H/8706–11

Physical Dimensions inches (millimeters)

Lit. # 108380



N16A (REV E)

Molded Dual-In-Line Package (N)
Order Number LM18293N
NS Package Number N16A

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